

SMUT CONTROL IN BARLEY



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INTRODUCTION

THERE are three distinct smut diseases of barley. They are as follows: Covered Smut, Loose Smut and False Loose Smut. The barley smuts are caused by parasitic fungi which partially or completely destroy the heads of the infected plants by converting them into dark, dusty masses of smut spores.

All of the barley smuts are seed-borne, but they fall into two distinct classes according to the manner in which the fungi responsible for them are carried over from one crop season to the next. Two of the barley smuts, Covered Smut and False Loose Smut, for instance, are carried over from year to year on the surface (outside) of the seed. These smuts can, therefore, be easily and effectively controlled by treating the seed with a suitable chemical. As the fungus responsible for the third smut of barley, namely, Loose Smut, is carried within (inside) the seed, not on its surface, applying chemicals to the surface of the seed is of little or no use as a means of control for this smut. Loose Smut of wheat can, however, be controlled by the "Hot Water" treatment, or other seed-soaking methods, but by far the best and most practical method of controlling Loose Smut of barley is to plant only smut-free seed.

The main object of this circular is to give farmers, grain buyers, and others reliable and up-to-date information concerning the control of the smuts of barley by seed treatment.

PREVALENCE AND IMPORTANCE

The three barley smuts are very generally distributed throughout the Prairie Provinces. To emphasize how prevalent the surface-borne smut diseases are in Western Canada, the results of smut tests made by the Line Elevators Farm Service on thousands of farmers' seed samples of barley from the crops of 1948 to 1952 are given in the accompanying table.

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Surface-borne Smut in Farmers' Seed Samples of Barley

Year seed produced	No. of samples tested	Percentage of samples contaminated with smut*
1948	1,369	92.4 (25.6)
1949	1,679	88.9 (20.6)
1950	3,149	89.2 (24.2)
1951	1,124	95.1 (48.2)
1952	1,584	93.4 (14.6)

*Figures in brackets represent samples in which smut balls or fragments of smut balls were found.

The figures in the above table show that over 93 percent of the seed stocks held on farms in Western Canada for planting in 1952 and 1953 was contaminated with surface-borne smut. Of the samples tested from the 1951 crop no less than 48.2 percent actually contained pieces of smutted barley heads.

In recent years it has not been difficult to find fields of barley in Western Canada in which, by actual count, 20 percent or more of the heads were destroyed by smut. Smut reduces yield in the approximate proportion of smutted heads to smut-free heads. Consequently if 20 percent of the heads in a field is destroyed by smut then the yield is reduced by 20 percent. On a 40-bushel crop this will be 8 bushels per acre.

Besides losses in yield the presence of smut in barley also seriously reduces the quality of the grain, and hence its market value. It has been reliably estimated that in recent years the total average annual loss from barley smut in the Prairie Provinces has not been less than 1.5 percent of the crop. On this basis western barley growers lost more than 3 million dollars in 1952 alone because of smut.

COVERED SMUT AND FALSE LOOSE SMUT

RECOGNITION

Covered Smut of barley is comparatively easy to recognize in the field. As shown in Figure 1, the hulls and awns are only partially destroyed. In other words, the spore masses, which replace the kernels, remain protected by a grayish-white, papery membrane until harvest time. During threshing, however, they are broken up, and the spores contaminate the sound grain. When such contaminated grain is sown without treatment, the spores germinate and the fungus then penetrates the seedling and continues to grow unseen inside the barley plant. It completes its life cycle by producing another generation of smut spore masses in the head.



Figure 1. Covered Smut of Barley.
Healthy head in centre.

these smuts may be controlled by treating the seed with an approved mercury-containing chemical.

CONTROL

Plant breeders are hopeful that, before too long, suitable varieties of barley possessing resistance to all of the smut diseases will be developed. However, the commercial varieties of barley that are at present most widely grown in Western Canada are susceptible to one or more of the smuts, and farmers must therefore rely upon seed treatment to reduce smut losses. The best advice we can give to farmers then is as follows. *Unless you are completely satisfied that your barley crop is practically free of smut, treat your seed each year.*

Approved Treatments. Covered Smut and False Loose Smut of barley can be controlled by use of an approved mercury-containing seed disinfectant such as Agrox C, Ceresan M, Half-ounce Leytosan, Leytosol C, Liquisan, Panogen, and P.M.A.S. These compounds give good control not only of smut, but of certain other destructive seed-

False Loose Smut presents a rather difficult problem when it comes to field identification for it cannot be readily distinguished from the true Loose Smut. Heads of barley infected with False Loose Smut look very much like those of Loose Smut as shown on the front page of this circular. However, although False Loose Smut looks like Loose Smut, its life history and control methods are very much like those of Covered Smut. In other words, False Loose Smut can be controlled by treating the seed with a suitable chemical. If, after properly treating his barley seed with an organic mercury dust or liquid, a farmer finds smut showing up in the crop, he can be almost sure that the kind of smut affecting his barley is Loose Smut and not False Loose Smut.

From the standpoint of control Covered Smut and False Loose Smut can be considered together, because the treatment is the same. Both of

borne diseases of barley as well. Furthermore, they afford considerable protection to the seed and seedling against disease-producing organisms that live and overwinter in the soil.

Besides the straight organic mercury compounds mentioned above, a number of dual-purpose seed disinfectants, such as Mergamma C, Leytosan G and Merlane, are now available as barley seed disinfectants. These compounds, which contain mercury (a fungicide) and Lindane (an insecticide), can be used to control smut and wireworms in one treatment. They should be used on barley wherever wireworms as well as smut are a problem. In using these dual-purpose chemicals be sure and follow closely the instructions of the manufacturer, particularly with respect to dosage and depth of seeding.

What, When and How to Treat. If best smut control results are to be obtained the seed to be treated should be clean, dry, and of good quality. A thorough cleaning of the seed will remove not only trash, dirt and weed seeds, but also many of the smut spores and fragments of smutted heads. Seed of barley that is very heavily contaminated with smut should be discarded and replaced by Registered or Certified seed, or any other seed stock that is known to be free or relatively free of smut.

Most modern seed-treating chemicals may be applied either as dusts, in the form of a thick paste or slurry, or as concentrated liquids, depending upon the type of seed-treating equipment available. However, no matter what chemical is used, nor in what form it is used, a thorough mixing of chemical and seed is essential. Every kernel should be uniformly coated with the chemical. A good machine, designed especially for this purpose, should be used to treat the seed.

Don't plant seed immediately after it has been treated. *Barley seed should be treated at least one week before sowing.* For best results the seed must stand long enough after treatment to allow sufficient time for the chemical to penetrate under the hull of the seed, and destroy any smut spores that may be lodged between the hull and the seed coat.

When using an organic mercury seed disinfectant avoid over-treatment as this may impair germination. Follow closely the dosage (rate per bushel) recommendations given on the container.

Precautions. The organic mercury seed disinfectants are poisonous and should be handled with caution. When treating seed be sure and wear a good respirator and, if at all possible, carry out the seed-treating operation in a well ventilated place, or better still—out-of-doors. Follow strictly the precautions given by the manufacturer.

Seed treated with an organic mercury compound should not be used for human consumption or fed to livestock. According to recent regulations issued by the Board of Grain Commissioners for Canada it is a serious criminal offence to deliver treated grain to an elevator.

Providing it is properly labelled and stored, treated seed may be held over and used the following year. If possible, however, all surplus stocks of treated seed should be sold as seed, or sown for green feed.

Other Treatments. Seed-treating chemicals containing hexachlorobenzene, as represented by Anticaric, Bunt-Cure, Bunt-no-More and No-Bunt, are not effective against the surface-borne smut diseases of barley. These chemicals should not be used on barley seed for smut control.

With respect to formaldehyde (Formalin). The practice of steeping or sprinkling barley seed with formaldehyde for smut control is no longer recommended. It is not only time-consuming but is likely to injure the seed and the young seedlings. Furthermore, treatment with formaldehyde is not effective against seed-borne diseases of barley other than smut, such as seedling blight and seed rot, and affords no protection against certain destructive soil-borne diseases of barley. On no account should severely frost-damaged, mechanically-injured, tough, damp or hulless seed of barley be treated with formaldehyde.

LOOSE SMUT OF BARLEY

RECOGNITION

Two heads of barley affected by Loose Smut are shown on the front page of this circular. In the case of Loose Smut not only the kernels but nearly all the chaff, also, are replaced by dark, powdery masses of smut spores.

Shortly after the smutted heads come out of the "boot", the smut spores are blown away by the wind; consequently, before long, nothing remains of the smutted head but a bare central stalk. Many of the released smut spores find their way into the flowers of healthy plants where they germinate almost immediately and infect the young developing seeds. However the seeds develop normally and show no external signs of the disease. Nevertheless, when such infected seeds are sown they produce plants with some or all of the heads destroyed by smut.

CONTROL

As the fungous parasite responsible for Loose Smut of barley is carried over from one year to the next deep inside the seed, not on its surface, treatment of the seed with a surface-disinfecting chemical, such as is used to control Covered Smut and False Loose Smut, is of little or no use in controlling this smut. Loose Smut can, however, be controlled by the "Hot Water" treatment, or other seed-soaking methods, but few farmers have the necessary equipment to carry out

these seed-soaking treatments effectively, that is, without great risk of causing some reduction in the germinating vigor of the seed. Ordinarily, they are recommended for small lots of seed only.

If properly done, the "Hot Water" treatment, and the recently developed "Spargon" treatment, will eliminate Loose Smut from barley seed. However, as modifications in both of these seed-soaking treatments are continually being made, we strongly advise farmers to get detailed instructions concerning their use from their provincial University, or nearest Dominion Laboratory of Plant Pathology (Winnipeg, Saskatoon or Edmonton).

The Line Elevators Farm Service is convinced that by far the best way of dealing with Loose Smut is to avoid it by selecting and planting only seed from crops that are recognized to be free, or relatively free, of the disease. The use of Registered or Certified seed, or seed from a segregated smut-free seed plot, will enable any farmer to keep his barley crop practically free of Loose Smut.

TREAT YOUR SEED

Smut tests made annually on thousands of farmers' seed samples of barley have shown that over 90 percent of the farm seed stocks of barley used each year in Western Canada is contaminated with the surface-borne smuts, and require seed treatment. The heavy losses caused by these smuts in recent years thoroughly justify the recommendation that all seed of barley be treated for surface-borne smut control. With barley particularly, seed treatment is a form of crop insurance that is available at a very low premium. Year in and year out there is no farm practice that will yield as great a return to the barley grower for so small an investment in time and money as seed treatment. Unless your seed is free or relatively free of smut, and undamaged, treat it.

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Additional copies of this circular, or of circulars dealing with the control of smut in wheat and oats, can be obtained from local Agents of any of the Line Elevator Companies listed above, or by writing directly to the Line Elevators Farm Service, Grain Exchange Building, Winnipeg, or Herald Building, Calgary.